

6. RESEARCH

Apart from the studies mentioned in Section 5.9.4, very little research in support of management has been done on Washington's high lakes by WDFW. This begs the definition of research, since WDFW staff biologists have surveyed hundreds of the lakes, and collected a great deal of information. Only a fraction of this information is published, and virtually all of it is in the gray literature. Local managers obtain and retain in their libraries work done by others, which in itself is a form of research (literature review). A very few examples of information obtained through literature review are Larson (1972) for Pratt Lake, near Seattle, and Rowe-Krumdick and Matthews (1991) for a cluster of high lakes in the western Alpine Lakes Wilderness.

Divens et al. (2001) identified five prioritized research needs on the subject of wildlife diversity and species protection. Initial field activity occurred on one of the tasks in the summer of 1999, but work was discontinued due to lack of funding. The topics were:

- Investigate which trout species, stocking rates and stocking intervals can provide quality trout fishing opportunities and do not significantly impact native biota;
- Evaluate the extent of emigration and fallout following high lake stocking;
- Investigate the effects of trout stocking on a landscape scale; experimentally evaluate if Washington's current high lakes management practices can eliminate, significantly reduce the abundance of, or significantly affect the general distribution of any native invertebrate, amphibian, or fish species in high lakes.
- Further investigate basic life histories of Washington's native amphibians; and
- Develop an evaluation procedure which can be used to identify any high mountain lake fish populations which may threaten native biota and test management techniques to decrease or eliminate the threat.

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APPENDIX A

Tenure Table of WDFW Inland Fishery Management Biologists

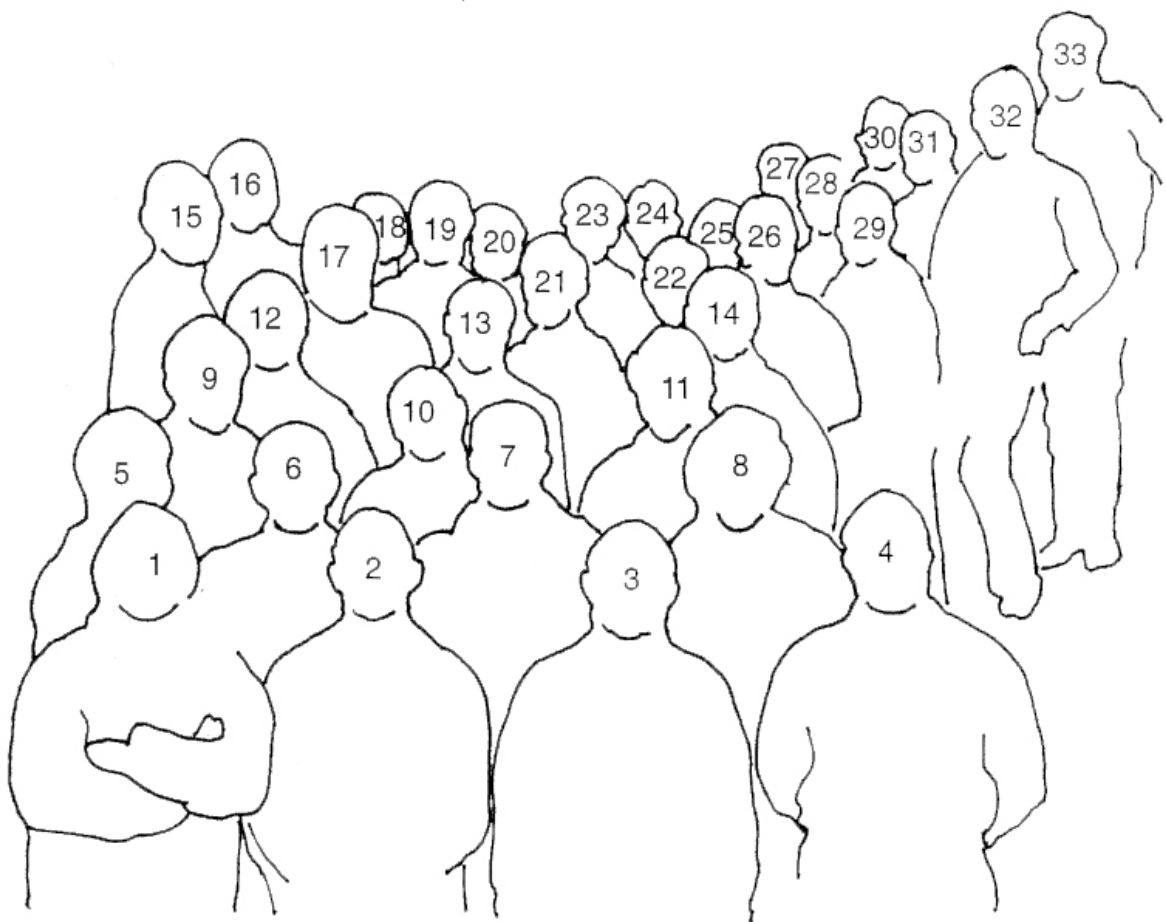
Appendix A Table 1.
Tenure of WDFW Inland Fishery Management Biologists,
by County, 1970- 2000.

Managed Counties	Biologists	Years as Local Manager
Pend Oreille	Tom Cropp	1974 – 1980
	Curt Vail	1981 – 2000
Clallam, Jefferson, Grays Harbor, Mason	Bob Watson	1970 – 1971
	Jim Johnston	1972 – 1973
	Tom Cropp	1974 – 1978
	Jay Hunter	1979 – 1998
	Dan Collins	1980 – 2000
Whatcom, Skagit; northern Snohomish	Louis Lund	1970 – 1977 ^a
	Tom Williams	1978 – 1982 ^b
	Jim Johnston	1984 – 2000
Southern Snohomish, King	Jim DeShazo & Bruce Crawford	1970 – 1974
	Jim Cummins	1975 – 1977
	Bob Pfeifer	1978 – 1999
	Mark Downen	1999 – 2000
Pierce	Jim Cummins	1970 – 1980
	Tom Cropp	1981 – 1996
	Steve Jackson	1997 – 1999
	Jay Hunter	1999 – 2000
Cowlitz, Lewis	Dory Lavier	1970 – 1971
	Jim Cummins	1972 – 1975
	?	1976 - 1977
	Bob Lucas	1978 – 2000
Skamania, Klickitat	Fred Holm	1970 – 1979
	Bruce Crawford	1980 - 1983
	Mark Chilcote	1984 - 1987
	John Weinheimer	1988 – 2000
Yakima, Kittitas	Bob Rennie	1970 – 1976
	Jim Cummins	1981 – 1987 Yakima County
	Larry Brown	1977 – 1980 Yakima County
	Larry Brown	1977 – 1993 Kittitas County
	Eric Anderson	1988 – 2000 Yakima County
	Eric Anderson	1994 – 2000 Kittitas County
Chelan	Fred Holm	1970 – 1972
	Lou Lund	1973 - 1980 ^a
	Jim Cummins	1981 - 1982 ^a
	Larry Brown	1983 – 1998
	Art Viola	1999 - 2000
Okanogan	Fred Holm	1970 – 1972
	Ken Williams	1972 – 1998
	Heather Bartlett	1999 - 2000

^a Year is estimated.

^b Tim Quinn filled in for one year when Tom Williams passed away.





- | | | |
|------------------|--------------------|----------------------|
| 1. Bill Young | 12. Tom Cropp | 23. Cliff Millenbach |
| 2. Wayne Brunson | 13. Tom Williams | 24. Merrill Spence |
| 3. Freddie Holm | 14. Dick Simons | 25. Larry Brown |
| 4. Ray Duff | 15. Ted Muller | 26. Dorie Lavier |
| 5. Doug Fletcher | 16. Ken Williams | 27. Jim Morrow |
| 6. Jerry Smith | 17. Tony Oppermann | 28. John Ward |
| 7. Dan Collins | 18. Jim DeShazo | 29. Dave Burns |
| 8. John Hisata | 19. Jim Cummins | 30. Lou Lund |
| 9. Rod Woodin | 20. Jack Ayerst | 31. Roy Banner |
| 10. Jim Nielson | 21. Bob Pfeifer | 32. Jim Johnston |
| 11. Jay Hunter | 22. Curt Kraemer | 33. Bob Watson |

APPENDIX B

Sample WDFW High Lake Survey Data Form

Alpine Lake Field Survey Form
Available in Hard-Copy Version Only

APPENDIX C

Sample WDFW High Lake Management Data Summaries

LAKE NAME: DOREEN

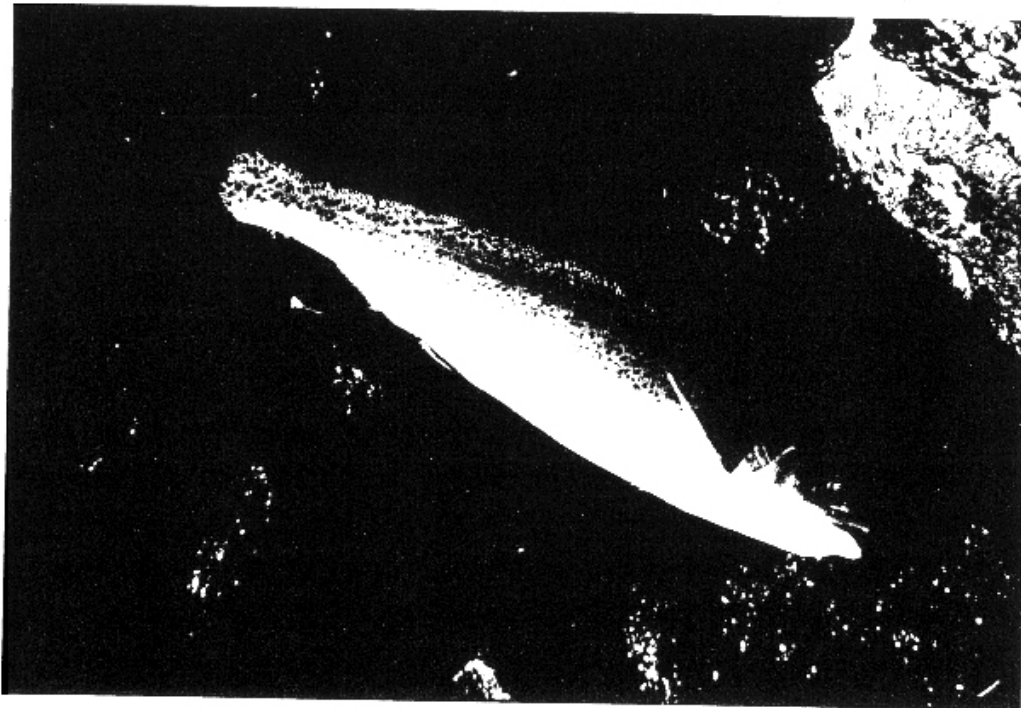
ELEVATION (FT): 3389 LOCATION: SECTION 09M T 37 N R 07 E COUNTY: WHATCOM SURVEY DATE: 08-21-90

LAKE OUTLET DRAINAGE: TO HWTRS SF NOOKSACK R

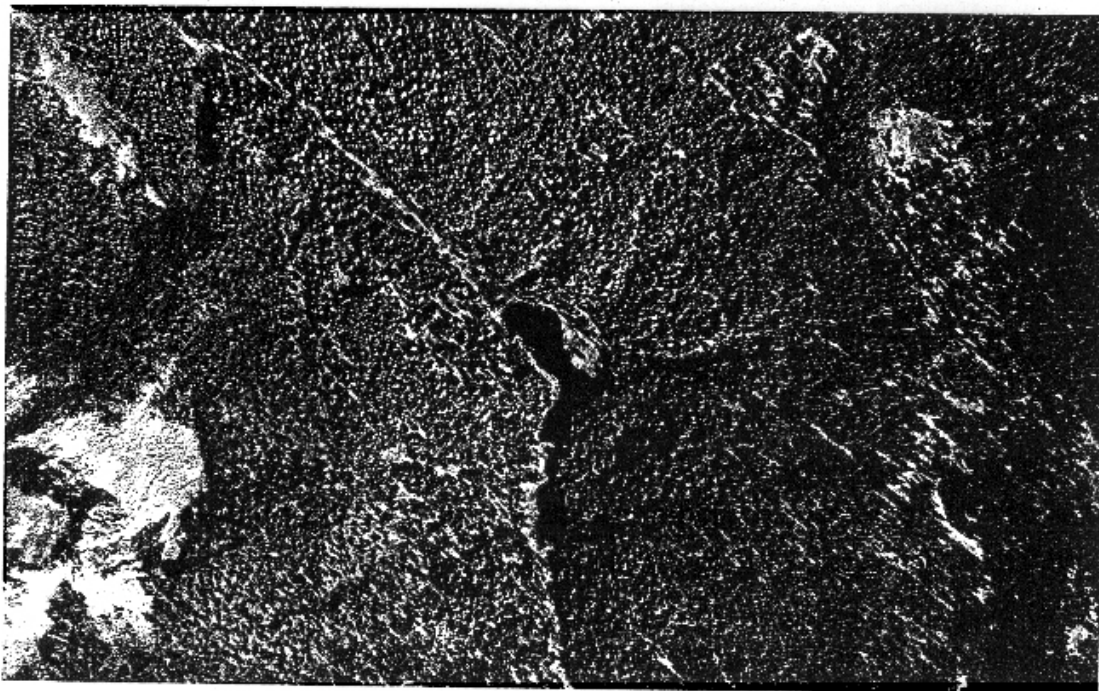
WATER IDENTIFICATION CODE (WACODE): 01 30 3753408L LK



LAKE PHOTO: LOOKING TOWARD OUTLET FROM WEST SIDE OF INLET



DOREEN LAKE RAINBOW: AGE 3, 185 MM IMMATURE FEMALE



USFS AERIAL PHOTOGRAPH: PHOTO DATE 08-02-86 PHOTO SCALE 1" = 1000' MARKER INDICATES LAKE LOCATION

DRAINAGE BASIN

MAP SCALE: 1" = 2000'

USGS MAP: TWIN SISTERS MTN, WA 1989

CONTOUR INTERVALS (FT): 40

LAND CLASSIFICATION: 82: USFS WILDERNESS

LAKE WATERSHED AREA (ACRES): 280

RATIO OF LAKE AREA TO WATERSHED AREA: 1:187

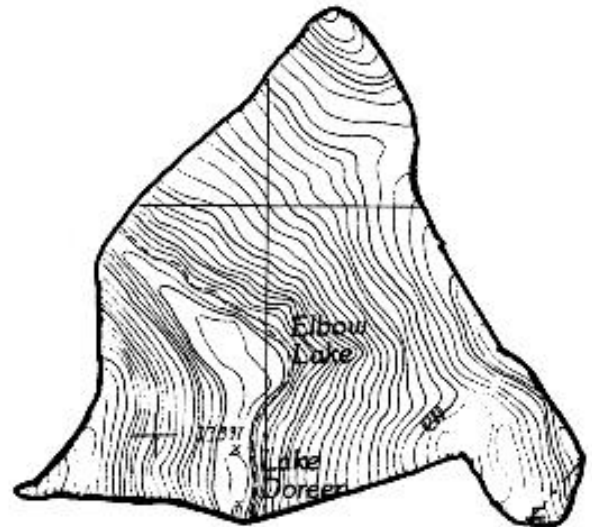
LAKE BASIN EXPOSURE DIRECTION AXIS: 200°

LAKE GEOMORPHIC TYPE: KETTLE

GEOLOGY (PARENT ROCK): CODE 6: GNEISS, DIORITE,
GREENSTONE AND POSSIBLE DUNITE PRESENCE

SOIL DEVELOPMENT: 3-8 FT DEPTH AROUND
PERIMETER OF LAKE AND 60% OF BASIN; REST
OF BASIN (WEST SIDE) 0-3 FT DEPTH

BASIN VEGETATION COVER: 90% VEGETATION COVER
WITH 80% CONIFER CANOPY



LAKE SURFACE AREA AND DEPTH

MAP SCALE: 1" = 400'

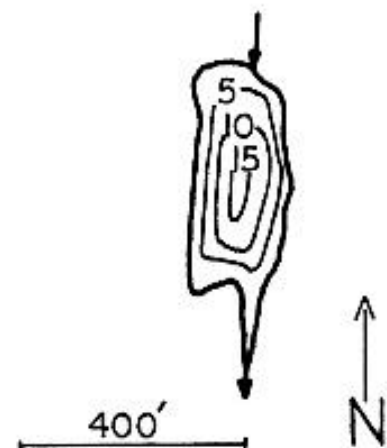
LAKE SURFACE AREA (ACRES): 1.5

ANNUAL WATER LEVEL FLUCTUATION (FT): 1

MAXIMUM DEPTH RECORDED (FT): 15

PERCENT LAKE SURFACE AREA OVER 0 - 10 FT BOTTOM CONTOURS: 73

PERCENT LAKE SURFACE AREA OVER 10 - 20 FT BOTTOM CONTOURS: 27



LAKE WATER CHEMISTRY

pH	CONDUCTIVITY (MICROMHOS/CM)	TOTAL ALKALINITY (PPM HCO ₃)	TOTAL HARDNESS (PPM CaCO ₃)	WATER COLOR/CLARITY
7.7	82	44	40	LT GREEN/CLEAR (10')

SUBSTRATE COMPOSITION OF LAKE BOTTOM SHOREWARD OF THE 10-FOOT CONTOUR LINE (PERCENT OF THAT AREA)

BEDROCK (SOLID ROCK OUTCROP)	0
BOULDER (ROCK GREATER THAN 10 INCHES IN DIAMETER)	0
RUBBLE (ANGULAR BROKEN ROCK LESS THAN 10 INCHES IN DIAMETER - INCLUDE ROUNDED ROCK 3 - 10 INCHES IN DIAMETER)	1
GRAVEL (ROUNDED MATERIAL LARGER THAN SAND BUT LESS THAN 3 INCHES IN DIAMETER)	1
SAND (PARTICLES 0.06 MM TO 2.0 MM DIAMETER; FEELS ROUGH BETWEEN FINGERS)	1
SILT (PARTICLES 0.004 MM TO 0.06 MM DIAMETER; FEELS GREASY BETWEEN FINGERS)	62
DETRITUS (DEAD ORGANIC MATTER INCLUDING TREE TRUNKS, BRANCHES AND LEAVES THAT ARE UNDERWATER)	35

INLET STREAMS (DRY OR FLOWING), ACCESSIBLE TO FISH DURING SPAWNING SEASON, THAT CONTAIN SPAWNING HABITAT

INLET NUMBER	LOW FLOW	LOW FLOW AVG	CUBIC FEET PER SECOND	LENGTH ACCESSIBLE TO SPAWNERS (FT)	ACCESSIBLE SUBSTRATE AREA WITH GRAVEL < 1.5 INCH DIAMETER (FT ²)	OBSERVED SPAWNERS			OBSERVED FRY (AGE 0)
	WIDTH (FT)	DEPTH (IN)				ADULTS	SPECIES	REDS	
PM ELBOW	8	4	0.5	TO ELBOW	20	0	--	2	8

ALLUVIAL FAN OR NEAR-SHORE SPRING AREAS THAT PROVIDE SUITABLE SPAWNING HABITAT

NONE WITH SUITABLE SPAWNING GRAVEL

OUTLET STREAM CONDITIONS

LOW FLOW	LOW FLOW AVG	CUBIC FEET PER SECOND	LENGTH ACCESSIBLE TO SPAWNERS (FT)	ACCESSIBLE SUBSTRATE AREA WITH GRAVEL < 1.5 INCH IN DIAMETER (FT ²)	OBSERVED SPAWNERS			OBSERVED FRY (AGE 0)
WIDTH (FT)	DEPTH (IN)				ADULTS	SPECIES	REDS	
8	7	0.5	300+	30 (IN 300')	11	RB	7	100+

NOTE: 200+ IMMATURE AGE 1 TO 3 FISH IN OUTLET STREAM.

AQUATIC VEGETATION AND SEDGE GRASS INCIDENCE AND AREA COVERAGE

TYPE	COMMON NAME	AREA COVERAGE (FT ²)
SUBMERGED	MOSS	200
SEDGE GRASS	SEDGE	600

AQUATIC INVERTEBRATE ABUNDANCE RELATIVE TO OTHER NORTH CASCADE MOUNTAIN LAKES

COMMON NAME	TAXONOMY	RELATIVE ABUNDANCE
ZOOPLANKTON	(PRIMARILY DIAPYCNUS KENAI):	MEDIUM
SHRIMP	(GAMMARUS)	NONE SEEN BUT REPORTED IN 1982
CADDISFLIES	(TRICHOPTERA):	HIGH
MAYFLIES	(EPTHEMEROPTERA):	MEDIUM
MIDGES	(PRIMARILY FAMILY CHIRONOMIDAE):	MEDIUM
BEETLES	(HEMIPTERA AND COLBOPTERA):	MEDIUM
DRAGONFLIES AND DAMSELFLIES	(ODONATA):	MEDIUM
FW SNAILS	(MOLUSCA)	MEDIUM

HUMAN IMPACTS NOTED DURING SURVEY

TRAIL CONDITIONS: USFS CONSTRUCTED, SIGNED TRAIL TO THE LAKE

HIKING TIME TO LAKE FROM NEAREST LOGGING ROAD APPROACH (IN 1992): 20 MIN

NUMBER OF FIRE RINGS NEAR THE LAKE: 1

ESTIMATED AREA OF TRAMPLED CAMPGROUNDS NEAR THE LAKE (IN SQUARE FEET): 50

IS THERE A TRAIL CIRCLING THE LAKE? NO, ONLY ON EAST SIDE

ARE THE CAMPSITES OR SHORELINE TRAIL IN AREAS OF SENSITIVE VEGETATION? NO

LITTER PROBLEMS: NONE

ESTIMATE OF NUMBER OF ANGLERS FISHING THE LAKE EACH YEAR: 150

ESTIMATE OF NUMBER OF NON-ANGLERS VISITING THE LAKE EACH YEAR: 300

FISH MANAGEMENT

FISH PLANTING HISTORY

<u>MONTH/YEAR</u>	<u>SPECIES</u>	<u>NUMBER</u>	<u>SIZE (NUMBER/POUND)</u>	<u>PLANTING RATE (NUMBER/ACRE)</u>	<u>PLANTING METHOD</u>	<u>ORGANIZATION</u>	<u>REMARKS</u>
/16	STB	UKN	FRY	UKN	HORSE	U.S. BUREAU OF FISH	SKAGIT R STEELHEAD
9/53	CT(TL)	3014	831	2009	AIR	WDG	--

ANGLER REPORT HISTORY

<u>MONTH/YEAR</u>	<u>SPECIES CAUGHT</u>	<u>NUMBER CAUGHT</u>	<u>HOURS FISHED</u>	<u>SIZE (INCHES) AVERAGE</u>	<u>RANGE</u>	<u>OTHER FISH OBSERVED</u>	<u>TOTAL ANGLERS</u>	<u>TOTAL NON-ANGLERS</u>	<u>FIRE RINGS</u>	<u>LITTER</u>	<u>REMARKS</u>
6/68	RB	2	--	--	11-19.5	SPAWNERS IN CR	--	--	--	--	PART FROZEN
	CT	2	--	11	11-11	& MOST 9-13"	--	--	--	--	& ELBOW FROZEN
7/68	RB	12	--	11	9-12	--	--	--	--	--	--
7/70	RB	2	--	8	8-8	MANY RISES	--	--	--	--	--
6/71	RB	5	--	8	7-8.5	--	--	--	--	--	60% FROZEN
7/71	RB	5	--	10	9-11	--	--	--	--	--	FISH FAT
9/71	RB	4	--	8	7-9	NUMEROUS	--	--	--	--	FISH FAT
7/80	--	0	--	--	--	FISH RISING	--	--	--	--	--
8/82	RB	3	--	9	8-10	SAW FISH 4-16"; FISH SPAWNING IN INLET & OUTLET;	--	--	--	--	FISH FAT
7/84	--	0	--	--	--	SAW 10-11" RB	--	--	--	--	--
9/90	RB	7	0.5	8	7-9	--	1	--	--	--	--

FISH SPECIES IN THE LAKE ON DATE SURVEYED: RAINBOW (STEELHEAD-ORIGIN)

SOURCE OF FISH CURRENTLY IN THE LAKE (NATURAL REPRODUCTION, HATCHERY PLANT OR BOTH): NATURAL REPRODUCTION

ESTIMATE OF FISH ABUNDANCE: MORE THAN 75/SURFACE ACRE

FISH SAMPLE TAKEN DURING 08/90 SURVEY AND 9/92 ELECTROSHOCKER COLLECTION

SPECIES	AGE	PORK LENGTH		SEX	SEXUAL MATURITY	CONDITION	STOMACH	FLESH	COLOR
		MILLIMETERS	INCHES				CONTENTS		
08/90									
RB	3	154	6.1	F	IMMATURE	FAT	SNAIL, CADDIS (L)	WHITE	
RB	3	157	6.2	F	IMMATURE	FAT	CADDIS (L, P)	WHITE	
RB	3	160	6.3	M	MATURE	FAT	SNAILS, CADDIS (L)	WHITE	
RB	3	161	6.3	M	MATURE	FAT	SNAILS, CADDIS (L)	WHITE	
RB	3	172	6.8	F	IMMATURE	FAT	SNAILS	WHITE	
RB	3	176	6.9	M	MATURE	FAT	CADDIS (L)	WHITE	
RB	3	181	7.1	F	MATURE	FAT	CADDIS (L)	WHITE	
RB	3	183	7.2	M	MATURE	FAT	SNAIL, CADDIS (L)	WHITE	
RB	3	185	7.3	F	IMMATURE	FAT	SNAIL, CADDIS (L)	LT PINK	
RB	3	185	7.3	M	MATURE	FAT	CADDIS (L)	WHITE	
RB	3	187	7.4	M	MATURE	FAT	CADDIS (L)	WHITE	
RB	4	203	8.0	F	MATURE	FAT	CADDIS (L)	WHITE	
RB	4	220	8.7	M	MATURE	FAT	CADDIS (L)	WHITE	
RB	4	220	8.7	F	IMMATURE	FAT	CADDIS (L)	WHITE	
RB	4	233	9.2	F	MATURE	FAT	CADDIS (L)	WHITE	
RB	4	235	9.3	F	MATURE	FAT	CADDIS (A)	WHITE	
RB	5	235	9.3	M	MATURE	FAT	SNAILS, CADDIS (L)	WHITE	
RB	5	242	9.5	F	MATURE	FAT	CADDIS (L)	WHITE	

9/92 ELECTRO-SHOCKER COLLECTION FROM OUTLET FOR TRANSPLANT TO WISEMAN (BIG AND LITTLE) LAKES AND TO UNNAMED LAKE SOUTH OF MOGINNIS (TJ16N R7E S5K) INCLUDED 260 TOTAL FISH FROM AGE 0 TO AGE 5. THE FOLLOWING WERE AGED.

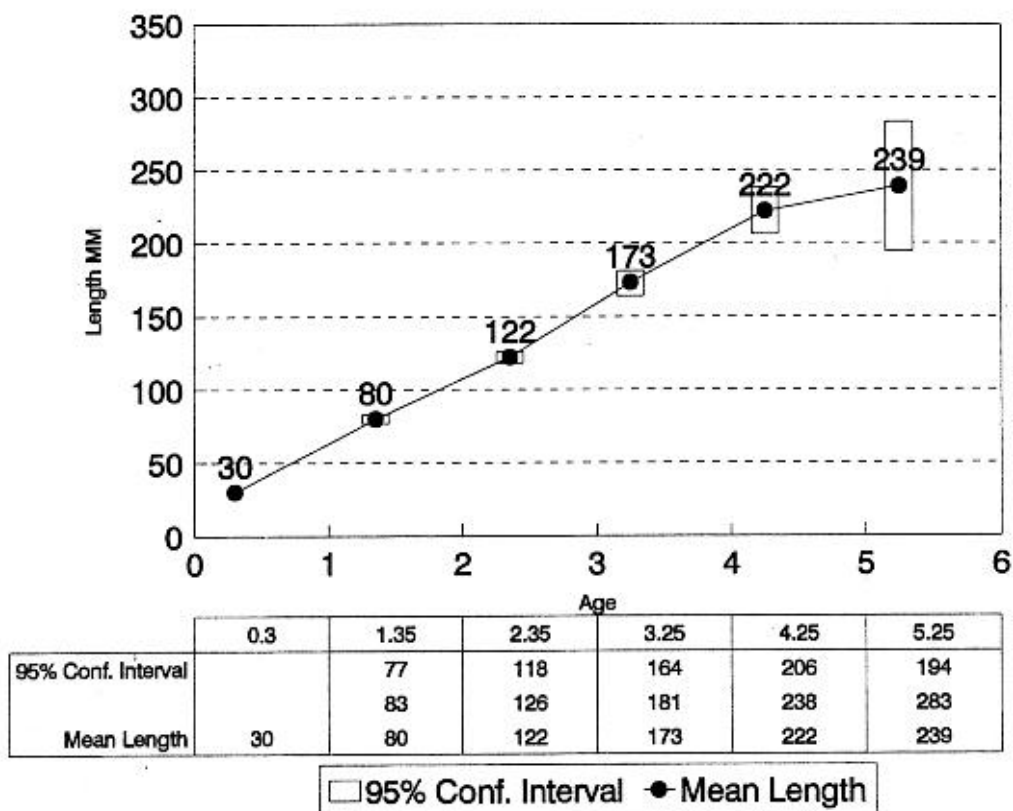
RB	1	76
RB	1	77
RB	1	77
RB	1	79
RB	1	80
RB	1	80
RB	1	84
RB	1	85
RB	2	116
RB	2	118
RB	2	120
RB	2	121
RB	2	124
RB	2	126
RB	2	127

AGE VERSUS LENGTH(MM) DATA FROM BIOLOGICAL SURVEY

SPECIES: RAINBOW (SKAGIT RIVER STEELHEAD ORIGIN)					
	AGE				
	1	2	3	4	5
N OF CASES	8	7	11	5	2
MINIMUM	76.00	116.00	154.00	203.00	235.00
MAXIMUM	85.00	127.00	187.00	235.00	242.00
RANGE	9.00	11.00	33.00	32.00	7.00
MEAN	79.75	121.71	172.82	222.20	238.50
VARIANCE	10.79	16.90	158.76	164.70	24.50
STANDARD DEV.	3.28	4.11	12.60	12.83	4.95
STD. ERROR	1.16	1.55	3.80	5.74	3.50
95% CONF. INTERVAL +/-	2.70	3.80	8.50	15.90	44.50
95% CI RANGE	77-83	118-126	164-181	206-238	194-283

Doreen Lk Rainbow Age/Lgth Data

Mean Length & 95% C.I. By Age



FISHERY MANAGEMENT CONSIDERATIONS

DOREEN'S RAINBOW, WHICH ORIGINATED FROM A PLANT OF SKAGIT RIVER STEELHEAD HAVE ADAPTED TO THE LAKE'S ENVIRONMENT AND ARE SUSTAINED BY NATURAL REPRODUCTION. PART OF THE WATER SOURCE FOR THIS LAKE ORIGINATES FROM AREAS OF DUNITE ROCK, WHICH CONTAINS HEAVY METALS CAPABLE OF KILLING PLANTED FISH BY AGE 3. BECAUSE DOREEN'S TROUT HAVE ADAPTED TO THESE METALS OVER SEVERAL GENERATIONS THEY SHOULD CONTINUE TO BE TESTED IN OTHER TWIN SISTERS MOUNTAIN RANGE LAKES AS A POTENTIAL DONATOR STOCK. THE HIGH RATE OF NATURAL REPRODUCTION SHOULD ALLOW REMOVAL OF UP TO 500 AGE 0 RAINBOW EACH YEAR WITHOUT REDUCING RECRUITMENT TO DOREEN TO A LEVEL THE CATCH RATE SUFFERS. THE REMOVAL SHOULD HAVE A POSITIVE EFFECT ON THE AVERAGE SIZE OF FISH REMAINING IN DOREEN LAKE.

APPENDIX D

High Lake Fishing Report Form

HIGH LAKE FISHING REPORT

Please fill in the blanks, check all appropriate boxes that apply, and add comments when necessary. This information is used by the Department of Wildlife to help obtain quality fishing in the high lakes.

Name of lake _____ Date of trip _____

County _____ Township _____ Range _____ Section _____ Subsection _____

Latitude _____ Longitude _____

Name of reporter _____ Hi-Laker ☐ Trail Blazer ☐

	RAINBOW	CUTTHROAT	GOLDEN	E. BROOK	BROWN	ATL. SALMON	GRAYLING	MACKINAW
QUANTITY								
SIZE RANGE								
AVERAGE SIZE								

QUALITY OF FISHING: Zilch ☐ Poor ☐ Fair ☐ Good ☐ Excellent ☐

FISH ACTIVITY: **Rising** None ☐ Few ☐ Lots ☐ **Cruising** None ☐ Few ☐ Lots ☐

FISH CONDITION: Fat ☐ Normal ☐ Thin ☐ Big head ☐ Spawning ☐ Dead fish seen ☐ Fry seen ☐

Other/Comments

SUCCESSFUL LURES: Bait ☐ Dry Flies ☐ Wet Flies ☐ Spoons ☐ Spinners ☐ Flatfish ☐

Other

STOMACH CONTENTS: Empty ☐ Copepods ☐ Shrimp ☐ Snails ☐ Larvae ☐ Surface Insects ☐ Debris ☐

Other

SENSITIVE SPECIES: Red copepods ☐ Gammarus ☐ Large Aquatic Insects ☐ Salamanders (NW ☐ LT ☐)

Other

TIME AT LAKE: Days _____ Hours _____ **TIME FISHING:** (Nearest 1/4 Hour)

#Anglers in party_____ #Other anglers at lake_____ #Non-Anglers at lake_____

LAKE CONDITION: Clear ☐ Glacial ☐ Dark ☐ % Frozen _____

Comments

CAMP USAGE: Heavy ☐ Moderate ☐ Light ☐ #of camp sites _____

WEATHER: Partly Cloudy ☐ Cloudy ☐ Clear ☐ Cold ☐ Warm ☐ Hot ☐ Windy ☐ Calm ☐

Snowing ☐ Raining ☐ Foggy ☐ Other _____

COMMENTS: _____

If confidential, check all boxes indicating who may see this report, check no boxes if all right to put in summary report:

Co-reporters ☐ Hi-Lakers ☐ Trail Blazers ☐ Department of Wildlife ☐

List Co-reporters here:

WEIGHT LENGTH DATA: As a general guideline, take weights only on fish that have been killed to take home, are part of a sample to be worked up for biological management purposes, or died for some other reason. Please be as accurate as possible.

[illegible]

Indicate units used

weight

☐ pounds

☐ ounces

☐ lb, oz☐ grams

length

☐ inches☐ centimeters[illegible]

APPENDIX E

Washington Department of Fish and Wildlife Fish Planting Card

**WASHINGTON DEPARTMENT OF FISH AND
WILDLIFE FISH PLANTING CARD
AVAILABLE IN HARD-COPY ONLY**

APPENDIX F

Sample Region Four High Lake Database Output

Thursday, May 06, 1999

KING COUNTY HIGH LAKE DATA SUMMARY

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NACODE: NAME		ALTNAME:		WRI:	BAS:	SEC:	PART:	TWP:	RNG:
1711402L MASON LAKE		BIG MASON; SHORT LAKE		07	80	05	A/B	22	10
ELEV:	AREA:	DEP:	WITHFISH:		STOCKED:				
4180	32.60	49	T		T				
ACCESS:	LAND:	F6RD:	LOCATION:					TOPO:	
T	45	NBRD	12 mi SE North Bend; 1800' S Kulla Kulla L; dr SF Snoq. R.					BANDERA	
REPROD:	HISTPL:	PLSP:	NOPERAC:	CYCLE:	BASEYR:	PLMETH:	YRASSN:	TBMAIN:	
NONE	RB SH	MW RB	24	3	1992	PLANE	1990	F	

NAME	DATE	YEAR	SP	BROOD	STERILE	HYBRID	SIZE	NUMBER	SOURCE	METHOD
MASON LAKE		1921	EB		False	False		20000		USFS
MASON LAKE		1921	RB		False	False		60000		USFS
MASON LAKE	08/09	1935	RB		False	False		10000		PACK - TB
MASON LAKE	08/26	1936	SH		False	False		10000		PACK - TB
MASON LAKE	06/25	1939	SH		False	False	2000	10000		PACK - TB
MASON LAKE		1945	RB		False	False		11790		PACK - TB
MASON LAKE		1952	RB		False	False		10000		PACK - TB
MASON LAKE	06/19	1958	RB		False	False	350	4000	TOKUL CREEK H	WDG FW
MASON LAKE	07/12	1961	MW RB	303	False	False	90	1800	ARLINGTON H	WDG FW
MASON LAKE	07/13	1961	MW RB	303	False	False	240	1200	ARLINGTON H	WDG FW
MASON LAKE	10/10	1968	RB		False	False	470	1000	ARLINGTON H	PACK - TB
MASON LAKE	08/08	1972	RB		False	False	270	3240	TOKUL CREEK H	WDG FW
MASON LAKE	08/18	1976	MW RB	303	False	False	100	2500	ARLINGTON H	HELO
MASON LAKE	08/24	1979	MW RB	303	False	False	135	2498	ARLINGTON H	WDG FW
MASON LAKE	07/16	1981	MW RB	303	False	False	305	2450	ARLINGTON H	WDG FW
MASON LAKE	08/21	1986	MW RB	303	False	False	150	1695	ARLINGTON H	WDG FW
MASON LAKE	08/07	1989	MW RB	303	False	False	400	1300	ARLINGTON H	WDG FW
MASON LAKE	09/10	1992	MW RB	303	False	False	530	975	ARLINGTON H	WDG FW
MASON LAKE	09/11	1995	MW RB	303	False	False	420	785	ARLINGTON H	WDFW - FW
MASON LAKE	09/30	1998	MW RB	303	False	False	205	820	ARLINGTON H	WDFW - FW

NAME	REPYR	REDATE	ANNO
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KING COUNTY HIGH LAKE DATA SUMMARY

NAME	REPYR	REDATE	ANNO
MASON LAKE	1956	07/15	Con Mattson had poor fg; blanked. Lk 3/4 open. Way tr poor cond on RH side outlet (N.B.). 2.25hrs, 2mis fr end "abandnd but passable lgng rd." (more)
MASON LAKE	1956	07/15	No shlters. Lk just opening. Many periwinkles crawling on bottom. Needs re-stocking. No one had caught a fish. A couple rises in center of lake.
MASON LAKE	1963	08/25	Fm had poor fg; none caught. A few 6" fish seen. Bait/lures. Heavy pressure. Trails good.
MASON LAKE	1965	06/03	The lake was completely frozen. Sno cvrd last haf of trail. 1.25hrs, 1.5mis fr High Valley. 1 set of trax in. 6' drifts arnd lake.
MASON LAKE	1965	07/01	Clarence Pautzke (!) had poor fg; skunked. Only saw 5 rises in evening. No snow. Good tr, 4.5hrs, 7.5mis fr Sunset Hiway. Many people. Fished out.
MASON LAKE	1965	07/02	Fm found none. Lk open. Good tr, 1.5hrs, 1.5 mis from "Hi Valley Logging Rd." 7fm seen on a FRI. Lots litter, 2 yrs ago good fg. Now appears barren.
MASON LAKE	1965	08/21	Al Odmark had poor fg; none caught. No sign of any fish. Good tr, but vry steep. 1.75 hrs, 2.5 mis. 15fm, 35 scouts. Needs stocking badly; much fishing pressure.
MASON LAKE	1965	08/21	John Kelly had poor fg; said "couldn't even get a strike." Good tr off lgng rd where xes outlet; 1.5hrs, 3 mis. BSA troop + 4 parties. Pretty clean of litter. No raft
MASON LAKE	1966	06/18	Fm said ice was just coming off. No fish evident.
MASON LAKE	1966	08/05	Con Mattson had poor fg. Full of 3" fish; fd only 1 hr w/eggs. 1fm rep'd taking 16" Rb. Gets hvy fg press. USFS should dig a garbage pit @ main camp spot.
MASON LAKE	1967	07/28	Bill Longwell said "On a clear day you can see forever." Had fair fg for 5 Rb ave 7", lrgst 8". Active; fd nr outl for 0.5 hr w/lures. Loved view fr Mt. Defiance top.
MASON LAKE	1968	06/02	Fm had fair fg for 5 Ct ave 9", lrgst 10". Ice just off and 1 school swmmng arnd perim. Took 1 fish on evry circuit of 40mins. 3fm, 1non. Exc Ct lake - best type seen.
MASON LAKE	1968	06/09	Fm did not fish; grp of Rb seen mvng arnd lk edge in evening tkng flies. 2fm seen; prob'y hvy press later judging fr amt of litter.
MASON LAKE	1968	06/22	Fm had fair fg for 6 Rb or Ct ave 8.5", lrgst 11". Active. In exc cond., well fed. Vry active. No fry seen. 4fm, 2non. Fair tr, hrd to follow.
MASON LAKE	1968	09/15	Fm had poor fg; none caught. 1 fm took 2 Ct 12"; "b'ful fish, fat w/full bellies." 4fm, 0non. Area in good cond. & well kept.
MASON LAKE	1968	09/15	Fm took 2 Ct 12-14". Well fed. Poor fg compared to earlier trip on 22 June.
MASON LAKE	1968	10/27	Charlie Lund had poor fg for 1 11" Ct. Vry little evdnce fish-appears abt fd out. 8fm, 0non. Lots use, but litter no worse than when last visited.
MASON LAKE	1969	08/02	Fm had poor fg for lrgst fish 4". (Unk # taken) Water quite warm. Sm fish numerous & active in shallows; saw 2 legal fish caught. 6fm, 3non.
MASON LAKE	1970	07/21	Bill Longwell had poor fg; blanked. So foggy couldn't see end of line; sum action nr shor by sm trout. 2fm, 0non.
MASON LAKE	1970	07/21	Fm had poor fg; none caught. Saw no activity @ 0900. Foggy-could not see across lk. 0 else. Tr good; amazingly clean for use it gets.
MASON LAKE	1970	08/27	Ed Lebert had poor fg; none caught. Saw svrl rises, and Rb @ 8". Didn't fish vry long. 5fm, 2non. Hordes been here earlier. Good tr. Pckd out much litter.
MASON LAKE	1970	09/10	Al Odmark had poor fg; none caught. Only 2 fish seen. Lures. 3 othr fm.

APPENDIX G

High Lake Fishery Cost: Benefit Technical Addendum

NOTES AND LOGIC ON HIGH LAKE FISHERY PARTICIPATION LEVELS, COSTS, BENEFITS AND ENVIRONMENTAL CONSIDERATIONS

PARTICIPATION LEVELS, HIKING AND HIGH LAKE FISHING

The Interagency Committee for Outdoor Recreation (IAC) published a 1987 survey in the Seattle Times listing recreational activities, with estimated household participations (x1000) and % growth rates for the state. Selected activities are listed below:

Rank	Activity	Participation (x1000)	%Growth Rate
1	Jogging	11,604	35%
2	Walking	8,756	44%
12	Dayhiking	3,218	37%
15	Fresh-water fishing	3,124	19%
26	Backpacking	1,273	30%
35	Off-road 4-Wheeling	737	35%
37	Off-road Motorcycling	691	32%
42	ATV driving	467	28%
48	Climbing/mountaineering	254	35%
50	Off-trail backpacking	198	31%

Jogging was most popular, followed by walking. Dayhiking (12th), fresh-water fishing (15th) and backpacking (26th) were also high on the list. Climbing/mountaineering (48th) and off-trail backpacking (50th) had participation levels about 7% of dayhiking and 2% of jogging and walking, a reflection of the greater skill level demanded by those activities. The IAC survey also indicated that non-motorized recreation (dayhiking, backpacking, climbing and off-trail backpacking) had over 2.5 times the participation level of motorized recreation (off-road 4-wheeling, off-road motorcycling and ATV driving).

The 1988 edition of 100 Hikes in the Glacier Peak Region estimated that Washington had a population of about 350,000 hikers (approximately 7.2% of the state's total population of 4.867 million and 9.7% of the over-18 population of 3.605 million). In a 1985 member survey by REI, a multiple-response question on regular activity participation showed hiking 59%, camping 58%, backpacking 43%, walking 41%, bicycling 40%, XC skiing 36%, jogging 35%, nature photography 31%, downhill skiing 31%, fishing 30%, swimming 29% and racquet sports 22% as most popular. Participation levels less than 20% were recorded for archery, bird watching, climbing, hunting, kayaking, power boating, rafting, sailboarding, sailing, scuba diving, team sports and canoeing. Of primary interest are the REI hiking and fishing participation rates, which taken together imply that 30% of hikers fish and 17.7% of REI customers are hiking anglers.

The number of fishing licenses sold by the State Department of Wildlife was 588,700 adult annual licenses in 1991 corresponding to about 16% of the state's adult population of 3.6 million. In addition, about 12,000 licenses were sold to non-resident visitors. Applying the REI angler participation percentages to the total number of hikers would lead to an estimate of 105,000 hiking anglers, amounting to about 18% of the licenses sold. The WDW surveyed license holders in 1988 and found that 65.4% were primarily lowland lake anglers, 23.6% were primarily stream anglers and 11.0% were primarily high lake anglers. The 7% difference between the estimate based on REI participation level and the surveyed primary interest would correspond to the cross-over interest among those who list streams or lowland lakes as primary, but who do some high lake fishing.

HIGH LAKE PROGRAM COSTS AND ECONOMICS

Hatchery costs to raise trout were estimated by John Kerwin to be \$5.35/lb @ 50/lb = \$0.094/fingerling and \$2.10/lb @ 4/lb = \$0.52/legal. High lake trout are stocked as fry, with a weighted mean size of all fish stocked in 1988 at 518.7/lb, which would correspond to \$0.013/fry for hatchery costs. In 1988, 298,809 fry were stocked statewide in the Alpine Lakes program. Annual high lake stocks of 300,000 fry would entail costs of \$3,900 while lowland lakes stocking of 3.5 million legals (= \$1,820,000) plus 10.4 million fingerlings (= \$977,600) plus 8.7 million Kokanee (= \$817,800) would entail hatchery costs of \$3.615 million, implying high lake hatchery costs are 0.08% of lowland costs.

In addition to hatchery costs, Bob Pfeifer estimated that he spent about 165 hours/year on the Alpine Lakes program, corresponding to salary/benefit costs of \$4,610/yr. He estimated that the other regional and area biologists spent about 80% of the time that he does on the program, corresponding to additional salary/benefit costs of about \$28,000. WDW Administrative charges the Fisheries Management Division at \$55/hour for fixed wing airplane time. Alpine Lakes airdrops were estimated at 5 days per year, 5 hours per day for divisional costs of \$1,375. Occasional helicopter use was estimated at 4 hours/year at \$425/hr. for \$1,700.

Total Alpine Lakes program costs are thus estimated at \$39,000. In fiscal year 1991-92, the WDW budget was reported to be \$53,592,000 (Report of the Budget & Review Committee, 6 August 1991). Thus the Alpine Lakes trout program represents 0.07% of the total WDW budget.

While the authors have not seen an economic evaluation of the recreational trout fishing program for the state, a chapter on "Economic Considerations in Managing Salmonid Habitats" showed recreational value estimates for trout fishing ranging from \$13-20 per angler per day (willingness to pay) for Idaho and California. Averaging these figures for our state assuming 100,000 high lake anglers making 6 trips per year would indicate a perceived recreational value of the high lake fishery of \$9,600,000 per year. Gear and equipment expenditures for high lakes fishing would be hard to separate from expenditures for hiking and lowland fishing as they will satisfy those combined interests, but they could be estimated as proportional to those license holders who indicated high lake fishing as their primary interest. Combined trip, gear and equipment expenditures could be approximated by the annual perceived recreation values as they are based on willingness to pay to participate.

APPENDIX H

Literature Review Relating to *Saprolegnia*

A LITERATURE REVIEW ON *SAPROLEGNIA* AND ITS RELATIONSHIP TO FISH STOCKING AND AMPHIBIAN MORTALITY

BACKGROUND

No one has identified a short list of one or two key factors leading to the declines seen in a variety of amphibian species, worldwide. The list of potential factors is long (Blaustein and Wake (1990, 1995), and it is very difficult, in many cases, to separate natural from anthropogenic causes (Pechmann and Wilbur 1994; Kiesecker et al. 2001). However, one proposed mechanism, introduction of the water mold *Saprolegnia*, deserves special treatment here, as it has been suggested that trout stocking could somehow be related to amphibian mortality caused by this fungus (Blaustein *et al.* 1994).

“The Saprolegniales, or water molds, occur most commonly in fresh water, but many of them inhabit moist soil. They are saprophytes living on dead plant or animal remains, or they are facultative or obligate parasites of algae, fish, and various small aquatic animals, or occasionally they are parasites of the roots of vascular plants” (Cronquist 1961).

Saprolegnia is just one of numerous genera in the Saprolegniales (Seymour 1970), a number of which are pathogenic to fish (Srivastava and Srivastava 1978; Pickering and Willoughby 1982). Srivastava and Srivastava (1978) found *S. ferax* to be as lethal as *S. parasitica* on their test fish (*Colisa lalia* and *Puntius sophore*), which were not salmonids. *S. ferax* was identified as the species involved in Blaustein *et al.*'s (1994) report of amphibian mortality. Pickering and Willoughby (1982) list nine species among three genera (*Achlya*, *Dictyuchus*, and *Saprolegnia*) as being “potential fish pathogens of the Family Saprolegniaceae” in their Table 1. It is important to identify *Saprolegnia* to below the generic level since not all *S.* species are pathological to trout (Willoughby 1978).

DISTRIBUTION OF *SAPROLEGNIA*

How broadly is *Saprolegnia* distributed? Apparently it's ubiquitous around the globe, as indicated by the following quotations, arranged alphabetically by author. Any emphasis added to the text is via boldening or underlining:

Blaustein, A. R. and D. B. Wake. 1995: “It turns out that since the late 1980s, increasing numbers of amphibians in Oregon have been sickened by the fungus *Saprolegnia*, which is found naturally in lakes and ponds.”

Blaustein, A. R., D. G. Hokit, R. K. O'Hara, and R. A. Holt. 1994: “Moreover, the fungus we identify is worldwide in distribution....”

Bly *et al.* 1996: “Winter saprolegniosis in channel catfish *Ictalurus punctatus* is associated with low temperature induced immunosuppression and invasion by a ubiquitous, opportunistic water mold, identified as a *Saprolegnia* sp.”

Kanouse, Bessie B. 1932: “The species of water mold that is found commonly on fish and fish eggs in fish hatcheries and in the fresh water lakes and streams belongs to the genus *Saprolegnia*.” “The fungus is widespread not only in America but also in Europe.” “The extermination of the fungus in hatcheries and in the fresh water lakes and streams is, of course, utterly impossible.”

Massachusetts CZM (1995): “*Saprolegnia* is a ubiquitous fungus and inhabits all freshwater.”

Pickering, A. D. and L. G. Willoughby. 1982.: “However, one subject that has not yet been considered is the relative abundance of pathogenic *Saprolegnia* spores or propagules in the environment. Reliable methods for quantitative estimation of propagules in fresh water are usually labour-intensive and tedious to operate. This, together with the fact that fungal identification may take several weeks, or even months, is responsible for the paucity of information on the abundance of pathogenic *Saprolegnia* propagules in natural water bodies.” “The species *Saprolegnia* implicated in fish pathology are probably best considered as facultative necrotrophs, forms which are normally saprophytic but which can also exist as parasites. It follows, therefore, that **their natural distribution in fresh water need have no correlation with the presence of fish.**” (Emphasis added.) “It would seem likely that pathogenic *Saprolegnia* spores or propagules are ubiquitous components of the microbial flora of most natural water bodies....”

PATHOGENICITY

While the previous extracts argue strongly for *Saprolegnia* likely being present even in “pristine” wilderness waters, or in the soil or wetland environments near lakes and ponds, conclusive demonstration of presence or absence is subject to the difficulties noted by Pickering and Willoughby (1982). The following extracts suggest that infection is associated with some level of stress or pathology in the organism prior to *S.* infection, and that the number of infecting agents (zoospores) in the environment need not be high. However, once an organism is infected, the number of propagules generated increases markedly. Again, listing authors alphabetically:

Massachusetts Coastal Zone Management (1995): “(*Saprolegnia*) invades most species of fish that have been subjected to some type of stress. It is also capable of infecting insects and amphibians. There is potential for infection whenever fungal zoospores are present in excess of 23,000 spores/liter.”

Richards and Pickering 1978: “Under hatchery conditions the background spore count may rise to over 20,000 spores/liter whereas the normal spore count does not exceed 5000/liter in Windermere and 4000/liter in Loch Leven.”

Pickering and Willoughby 1982: “Mucus removed from the surface of the fish triggers encystment of zoospores of the pathogenic strains and mycelial growth ensues rapidly.” “It would seem likely that pathogenic *Saprolegnia* spores or propagules are ubiquitous components of the microbial flora of most natural water bodies and that potential hosts are constantly challenged by the pathogen. Under these circumstances, changes in the host and in the environment may be at least as important as changes in the pathogen load of the water in determining the outbreak of fungal infections. Once an outbreak occurs, the presence of infected fish ensures that the spore count in the water rises dramatically.” “Based on his work with Pacific salmon, Neish (1977) emphasized the role of stress in initiating *Saprolegnia* infections.”

Willoughby, L. G. 1962: "At Windermere lake margin total Saprolegniales estimation figures ranged from <25 to 5200/liter. At Windermere lake center total Saprolegniales estimation figures were never more than 100 per liter and a mean figure of 11 per liter was derived for this situation. At Wraymires Fish Hatchery total Saprolegniales estimation figures ranged from 400 to 4600 per liter." "In the waters investigated, *Saprolegnia* was easily the most conspicuous genus, followed by *Achlya* and *Aphanomyces*."

INTERPRETATION

Wraymires Hatchery obtains its water untreated from adjacent Lake Windermere. (Windermere and Loch Leven support numerous fish species.) Willoughby found that water from the edge of Windermere carried higher zoospore levels (25-5200/L), but water in the lake's center had far fewer. Pumping of nearshore lake water into the hatchery environment resulted in an intermediate count of propagules, as would be expected (400-4600/L). This is more than adequate to initiate infection in fish which are compromised in some way. In the natural environment, stress may be more important in initiating fungal infection than a prior infection or injury (Neish 1977).

Blaustein *et al.* (1997) provided strong evidence of the susceptibility of long-toed salamander eggs to mortality from UV-B radiation. Earlier, Blaustein and Wake (1995) stated: "Because ultraviolet rays can impair immune function in many animals, it seems reasonable to guess that some amount of egg damage in amphibians is caused by an ultraviolet-induced breakdown in the ability of amphibian embryos to resist infection by the fungus." We totally agree!! They also stated that eggs of Cascade frog and western toad are similarly vulnerable. *Saprolegnia* is ubiquitous in the freshwater environment. It is probably found at very low levels in wilderness lakes, whether or not they contain fish. Given the long list of environmental insults to which amphibians are subject, we do not believe one can infer from Blaustein *et al.* (1997) that *Saprolegnia* is, or has been introduced to wilderness waters where it did not previously exist. We believe it is much more likely that the populations which succumbed to *Saprolegnia* in Blaustein *et al.*'s (1997) study suffered infections by a previously-present fungus after having been compromised in some way by UV-B radiation.

Comment and Relationship to Washington High Lake Management:

Washington's high lake stocking program is one of maintenance, not expansion (Figures 2, 3). In fact, the number of lakes being stocked is decreasing (Figure 3) due to a recent trend of some fish stocks to successfully reproduce (thought to be related to climate change and length of growing season). Therefore, the potential of introducing *Saprolegnia* into waters where it does not currently exist via trout fry stocking is near zero. If the fungus has been introduced into any lakes through trout stocking, it probably occurred in the distant past, well before anyone took notice of amphibians suffering massive *Saprolegnia* infections (see Section 5.5 and Table 17).

COMMENTS ON SPECIFIC REFERENCES

Blaustein, A. R., D. G. Hokit, R. K. O'Hara, and R. A. Holt. 1994. Pathogenic fungus contributes to amphibian losses in the Pacific Northwest. *Biological Conservation* 67:251-254.

Comment/s and Relationship to Washington High Lake Management:

The authors state: “*Saprolegnia* is an important worldwide pathogen of fishes, especially those species reared in hatcheries (refs.).” This is an egregious error in syntax. What they probably meant to say, based on reality, is: ...especially ***when*** those species ***are*** reared in hatcheries (emphasis added, but even then the sentence is not universally true). Their sentence, as published, infers that fish species which are cultured in hatcheries, are subject, *ipso facto*, to *Saprolegnia* infection. This is untrue, and implies that all trout reared in hatcheries are likely to be carrying *Saprolegnia* infections. While there is no doubt that hatchery culture can, under some circumstances, greatly increase the count of *S.* zoospores in the rearing water and thereby increase the chance of infection in compromised fish, it does not necessarily follow that fish which have received proper prophylactic care are stocked carrying *Saprolegnia* infections.

These authors cite a number of other studies where various amphibian species (*Rana*, *Bufo*, etc.) succumbed to *Saprolegnia* **in temporary pools** (emphasis added). Unless these same ephemeral ponds were stocked with fungus-bearing trout at the same time the amphibians spawned, it requires a leap of logic to connect trout stocking to those frog die-offs. Sympatry with stocked trout was presumably not a pre-requisite in those mortality studies. However, the authors also “hypothesize that individual amphibians may transmit the pathogen to other populations as they migrate or disperse.” Hypotheses are not the same as fact.

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APPENDIX I

Historic Trail Blazer Stocking, by County

Appendix Table I. Trail Blazers, Inc. stocking trips, by county and decade, in Washington State.

County	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s
Chelan	6	3	13	18	30	91	121	3
Cowlitz						1	4	
Jefferson				8	1			
King	83	102	118	184	208	283	314	36
Kittitas		13	11	38	50	107	134	14
Lewis			1	8	6	21	86	1
Okanogan				6	5	3	7	4
Pierce				1	17	18	20	1
Skagit			18	60	40	74	119	5
Skamania					9		9	
Snohomish	3	18	54	85	117	202	275	17
Whatcom			1	32	13	57	55	6
Yakima			4	3	1	12	11	2

APPENDIX J

Summary Management Statistics by WDFW Manager

Appendix Table J. Washington high lake management statistics by county and WDFW management biologist.

Region	Manager	County	Number of Lakes	Number in Park	Number Surveyed	Number w/Plan	Number Managed	Number in Region w/Fish	Percent w/Fish	Repro Status Deter'd	Percent
1	Vail	Pend Oreille	31		15	15	15	3	10	15	100
2	Bartlett	Okanogan	321		108	108	240			89	36
2	Viola	Chelan	402	28			302	331	46	171	57
		Kittitas	221			167	167			167	100
3	Anderson	Yakima	367			154	154	227	39	154	100
5	Weinheimer	Skamania	382		250	250	250	206	29	250	100
		Cowlitz	13		11	11	11			11	100
5	Lucas	Lewis	315	35	171	171	171			171	100
		Pierce	277	166			51				
6	Hunter	Mason	93				24	182	18		
		Grays Harbor	25	2	3	3	5			3	60
		Jefferson	543	366	17	17	19			17	89
6	Collins	Clallam	90	75	0	0	0				
		King	572		323	323	532			346	79
4	Jackson	So. Snohomish	143		80	80	143			86	74
		No. Snohomish	252								
		Skagit	311	52						56	
		Whatcom	360	200						47	
4	Downen	Aggregate	(837)		98	98	187	828	51		
Total:			4718					Mean:	38	Mean:	83

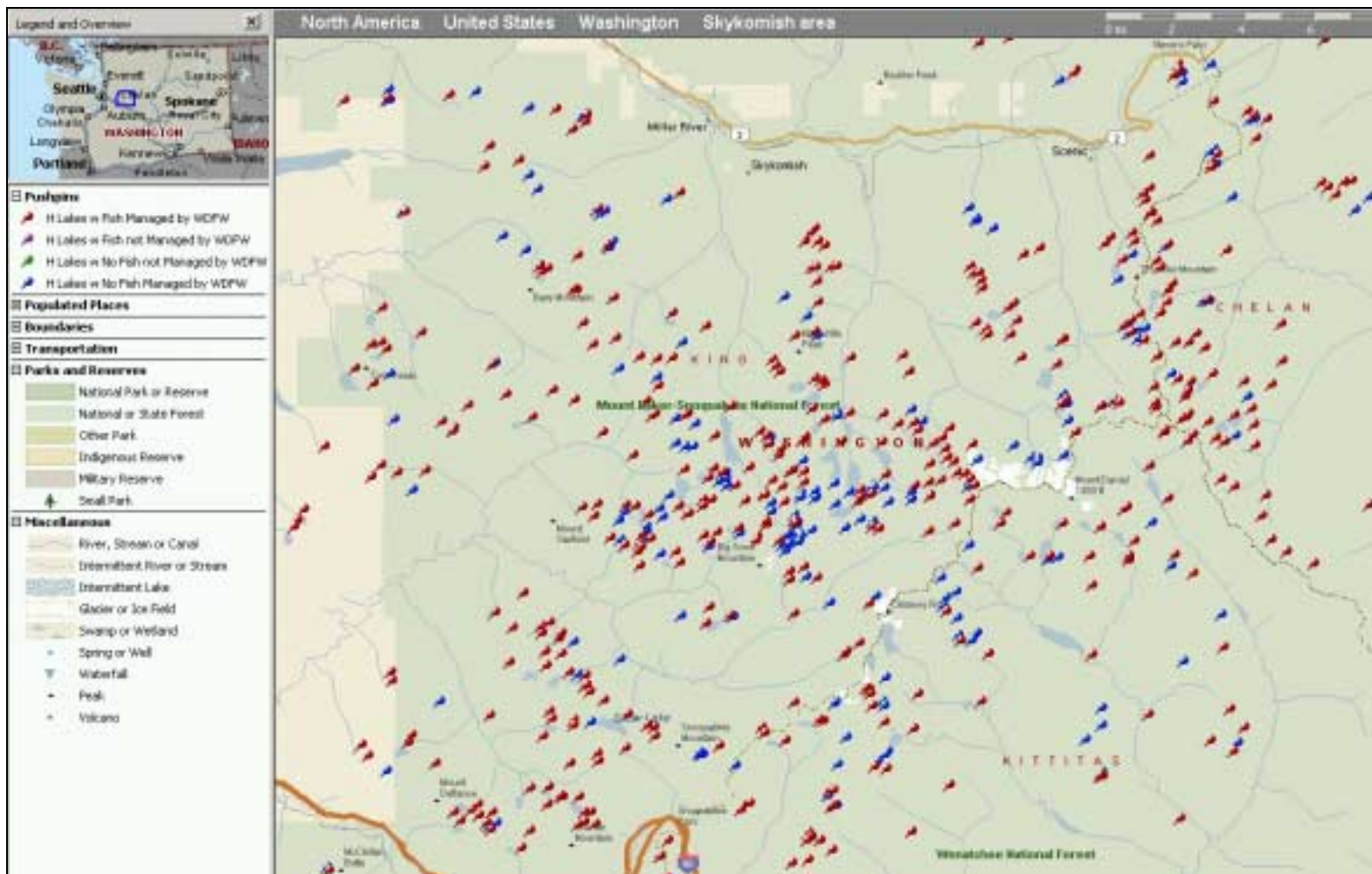
APPENDIX K

Distribution Maps of Washington High Lakes

Appendix Plate K-1. Density of high lakes by county in Washington State.



Appendix Plate K-2. Distribution of high lakes with and without fish between SR 2 and I-90 in the central Cascades. Note the presence of fishless lakes throughout the area, and in most sub-basins of the upper Snoqualmie, Skykomish, and Yakima River Basins.



APPENDIX L

**Goals, Policies, and Objectives by the Washington Fish
and Wildlife Commission. February 2, 1995**

**Goals, Policies, and Objectives by the
Washington Fish and Wildlife Commission. February 2, 1995
Available in Hard Copy Version Only**

APPENDIX M

Agency Guidelines and Memoranda of Understanding

**Agency Guidelines and Memoranda of Understanding
Available in Hard-Copy Version Only**

APPENDIX N

High Lakes File

The attached High Lakes File was used as the basis for several figures and tables in this report. Not all the detailed data used for the report is included in the file. However, the lake names, identification numbers, size, location, administrative areas are included. The lakes are ordered by County, Township, Range, Section and Lake Name in memory of Ernest Wolcott who used that ordering in his Lakes of Washington volumes.

HIGH LAKE TABLE FIELD DEFINITIONS

Field Name	Type	Comment
CountyName	Text	County name
Township	Text	Public Land Survey Township
Range	Text	Public Land Survey Range
PSection	Long Integer	Public Land Survey Section
PSectionSuffix	Text	Section subdivision using Wolcott method
Lake Name	Text	Primary lake name. Unnamed lakes use Unnamed-Elevation for a name
Other Names	Text	Other lake names in use
HighLakeFlagWDFW	Yes/No	Flag identifying a high lake or pond based on WDFW criteria
HighLakeException	Yes/No	Flag identifying lake that does not meet WDFW high lake criteria but is being managed as a high lake by regional biologist.
FishStocked	Yes/No	Flag identifying that the lake has ever been stocked with fish
FishSeen	Yes/No	Flag identifying that a fish has ever been observed in the lake
Organization	Text	The organization managing or owning lake property
Admin	Text	Administrative area name if any
CU	Text	USGS basin (hydrologic unit) code
FSWatershed	Text	Forest Service 5 th and 6 th level watershed code
LakeBasin(Acres)	Single	Lake basin drainage area (acres)
Reach	Text	Reach identifier imported from USGS/EPA Reach File or assigned by Mike Swayne Trail Blazer Librarian using Reach File identification methodology
DownReach	Text	Downstream lake or stream name
RDOCode	Text	Regional WDFW biologist lake code
SDOWCode	Text	State WDFW lake MUCODE
Lake2k	Long Integer	State WDFW GIS lake code
NPSCode	Text	North Cascade National Park lake code
Wolcode	Text	Wolcott code (Volume.Page.Item.subitem)

CurtisID	Integer	Lake code developed by Walt and Brian Curtis used in Hi-Laker High Lake database
Location	Text	Lake location description, distance and direction from named feature
SurfaceArea	Single	Lake area (acres)
AvgDepth	Single	Average lake depth (feet)
MaxDepth	Single	Maximum lake depth (feet)
MaxDepthQual	Text	Maximum depth qualifier
Outlet	Yes/No	Outlet exists flag
Shoreline	Single	Shoreline length (miles)
Elevation	Integer	Elevation above mean sea level (feet)
DLat	Double	Latitude decimal degrees NAD27
DLong	Double	Longitude decimal degrees NAD27
LLPosition	Text	Lat/Long position (Center, drainage outlet)
MapCode	Text	USGS Map code
MapName	Text	USGS Map name